

Canada-U.S. Convergence in Environmental Regulation: The Case of Marine Vessel Emissions

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ABSTRACT

Marine vessel emissions are a significant source of air pollution in British Columbia's Lower Fraser Valley and in Washington State. One recent study concluded that ships are the major source of sulfur dioxide, which contributes to smog and acid rain, in the Greater Vancouver area. Marine vessels also emit particulates, which are associated with human health problems such as asthma, bronchitis, and reduced lung function. While emissions from land-based pollution sources are decreasing as a result of improved fuels and technology, ship emissions are increasing as a percentage of overall emissions.

Ships have been characterized as the world's most unregulated transport. There are a number of reasons for this, including underestimation of their emissions, the difficulty of regulating foreign vessels, and concerns over the competitive effects of regulation. As knowledge of the significance of this air pollution source grows, however, air quality managers and ports have begun to test the feasibility of different approaches to reducing marine vessel emissions. Clean fuel requirements, requirements to use electrical generators while in port, fines for running engines while docked, and subsidies for tugboat engine upgrades are among the measures that have already been adopted in some areas.

Because of the competitive implications of regulation, this issue is an obvious and logical focus for transboundary cooperation. Possible cooperation approaches that would create a level playing field at ports in the United States and Canada are being developed by the Georgia Basin-Puget Sound International Airshed Strategy Coordinating Committee, and ad hoc group of air quality managers and environmental agency personnel from both sides of the border. This group, which has been meeting biannually for the past three years, has designated the development of a policy to address marine vessel emissions as priority for action. This paper will discuss the likely convergence of Canadian and U.S. management of marine vessel emissions based on mutual concern over the impacts of pollution and the economic effects of unilateral regulation.

Political boundaries are defined by imaginary lines that are drawn on a map and have little if any regard for the environment. Additionally, political boundaries, which define

political, social, economic and demographic systems, affect the management of shared natural resources (Spenner 2001). Transboundary environmental management practices will further attract attention as populations rise and environmental problems escalate. Reducing air pollution, in particular, is a high priority for many regions around the world because of the undisputed importance to sustain life and the uncompromising uniqueness of air to flow freely across political boundaries (Paule 1996, Spenner 2001).¹ When analyzing political systems, the question is not whether political issues will arise, but whether political regimes can effectively manage transboundary issues associated with air pollution.

The study of the Georgia Basin/Puget Sound region offers a unique opportunity to investigate the potential for transboundary environmental regimes' effectiveness, especially addressing air quality management. Based on a mutual concern over the impacts of pollution and the economic effects of unilateral regulations, it is likely that Canada and the U.S. will converge on management issues addressing marine vessel emissions.

To address this conflicting view of environmental management, it is important to understand the importance of air quality and the current frameworks of environmental regimes addressing air quality, emphasizing marine vessels emissions.

Importance of Air Quality

Air quality can have significant affects on human health, the environment, and local economies. In particular, there are many health affects associated with poor air quality. Nitrogen oxides (NO_x) and sulfur oxides (SO_x) can cause respiratory effects, including chest pain, coughing, shortness of breath, acute respiratory problems that aggravate asthma, decrease lung function, and decrease the immune system leading to the susceptibility of respiratory illness. PM_x causes a range of human health problems, including premature mortality, aggravation of respiratory and cardiovascular disease, aggravated asthma, acute respiratory symptoms including aggravated coughing, painful breathing, decreased lung function, and symptoms of immunological effects such as wheezing and increases in allergies (Somers 2004).

As human health is affected by poor air quality, so is the environment. SO_x, a constituent of acid rain, damages buildings, erode soils, decreases soil productivity, and damages flora. NO_x, a component of ozone (O₃), contributes to climate change and reduces crop yields and the productivity of forest lands. PM_x can also affect the environment by causing soil and erosion damage that can include culturally important objects, such as monuments and statues (Somers 2004).

The environment and human health may have sizeable ill effects as a result of poor air quality, so does tourism. For example, particulate matter (PM_x), small airborne particles, are a major component to haze that contributes to reduced visibility. This reduction in visibility can cause negative impacts on transportation safety, aesthetics, business and tourism (GBEI 2003). Within the region a very poor visibility day could result in the loss of over \$8 million in future tourist revenues for the Lower Mainland and Fraser Valley and in 2002 health effects related to air pollution in the Fraser Valley were estimated at \$2 billion (USD) (Genesis 2002, GBEI 2003, Delucchi et al 2002).

Air quality in the Georgia Basin/Puget Sound region is of particular concern. While, pollutants as SO_x, NO_x, and PM show slight downward trend, they still pose a threat to the region (GBEI 2003). Comparably, PM₁₀ levels across the Georgia Basin/Puget Sound region

¹ This is analogous to Paule's *Underground Water: A Fugitive at the Border*.

are similar with other areas nationwide but have the opportunity to decline dramatically.² The primary source of PM₁₀ in the Georgia Basin/Puget Sound region is mobile emissions. This includes cars, large diesel fleets, and marine vessels. Of these mobile sources, marine vessels account for an extremely large portion of this emissions inventory and are comparable to motor vehicles (GBEI 2003). This can be attributed to the Georgia Basin/Puget Sound region being strategically located to the Pacific Ocean and Pacific Rim countries as well as its many ports.

The Georgia Basin/Puget Sound Ecosystem

The Georgia Basin/Puget Sound ecosystem stretches as far south as Olympia and as far north as the Campbell and Powell Rivers. Its water marine component is comprised of the Strait of Juan de Fuca and Strait of Georgia. This inland sea is characterized by a convoluted network of deep basins, long channels, narrow shallow tidal passages, sheltered embayments and islands connecting the Pacific Ocean. The ecosystem is ringed by the crests of the Olympic Mountains, Vancouver Island Ranges, the Coast Ranges and the Cascades (Hildebrand et al 2002). In between all of this magnificent landscape lies an invisible political boundary that divides the United States and Canada (see Figure 1).

This ecosystem, combined with the natural beauty of its ocean front access and forested landscape and the economic opportunities in trade and technology, this region has drawn many to the Georgia Basin/Puget Sound region. Today, the region is home to two major metropolitan cities; Vancouver, British Columbia and Seattle, Washington. These large urban centers have a combined population of which are almost 4 million people (Melious 2003). Presently, the Georgia Basin/Puget Sound ecosystem is home to just fewer than 8 million people and is growing rapidly (Melious 2003). This increase in population is an enormous impairment upon the region and its environmental amenities. The very quality of life that attracts people to the region is precisely what threatens it the most (Hildebrand et al 2002). A major question facing the ecosystem is whether population growth can be accommodated without destroying the environment and consequently the quality of life of the region's residents.

Georgia Basin/Puget Sound Region Partnership

On both sides of the border increases in population has led to concerns over the environment, health, and economic impacts of air pollution (GBEI 2003). The problem of air pollution is a large concern on both sides of the border, but not until the late 1980's did either country start to look at the issue of air pollution as a priority for the region. With this being said, transboundary agreements are still in an early development phase.

Not until recently has the Georgia Basin and Puget Sound regions experienced a shift towards a more formal partnership—this partnership focuses on common approaches for reaching sustainability goals. The Georgia Basin/Puget Sound partnership has set the stage for a new wave of municipal and regional planning, grounded on urban containment, compact communities, and comprehensive transportation planning goals. These goals include, but are not limited to, sustainable growth management and in particular; a greater understanding of transboundary air quality and airshed management (Hildebrand et al 2002).

² This is decline in air pollution may be the results of stringent standards being implemented through federal legislation.

Marine Vessel Emissions

Marine vessel emissions are an issue that has arisen throughout the world. The European Union, Sweden, California, and the International Maritime Organization (IMO) are all groups that have or are attempting to regulate marine vessel emissions. While this issue is being looked at throughout the world, it has only just begun to be regarded as a major issue in the Georgia Basin/Puget Sound region (IAS 2004). Currently, neither the United States nor Canada has any restrictions on marine vessel emissions. With a common goal between British Columbia and Washington to address air quality and airshed management, marine vessel emissions offers an opportunity for both nations to cooperatively address management options to regulate marine vessel emissions. As noted by the Environmental Protection Agency in regards to transboundary management; to be “successful, you’re going to have to pick some particularly egregious, high-profile problems and get them solved.” (Branscombe 2002) Marine vessel emissions appear to be the most “egregious, high-profile problem” within the Georgia Basin/Puget Sound region.³

In 2000, Marine vessels within the Georgia Basin/Puget Sound region accounted for approximately for 59% of the SO_x, 22% of the NO_x, and 5.6% of the PM_x in the Lower Fraser Valley. Not later than 2010, marine vessel emissions are expected to be the largest single source of air pollution within the Georgia Basin/Puget Sound region (MVE conference 2004) and by 2025 it is estimated that SO_x will rise by 34% and PM by 39% (Quan et al 2002). What are unique about these emission factors is that not until recently, 2000, were marine vessels taken into account within the regions air emissions inventory analysis (Levelton 2004).

Management

Canada and the United States have the largest undisputed border in the world, with 5,526 miles of shared borderland. The stable nature of this border provides an opportunity to look at transboundary management issues without the burden of stressed political relations (Spenner 2001). As Young (1998) point out:

Relationships between Canada and the United States have long been fertile grounds for the development of regimes intended to solve transboundary problems and, in process, to institutionalize cooperation in well-defined areas.

The border between Canada and United States divides the Georgia Basin/Puget Sound region into two distinct political systems; however, air pollution still flows freely between Washington and British Columbia. While the environment has no borders, Canada and the United States do. This divergence among the two political systems has stimulated minor controversies throughout history but have resulted in agreements as the Boundary Waters Treaty 1909 and the Pacific Salmon Agreement 1999. Today, the region is developing relationships to address transboundary issues. Specifically, the region is looking at the overall problem of air quality, but little if any movement is being made to address marine vessel emissions.

The difficulty in managing marine vessel emissions within the Georgia Basin/Puget Sound region can largely be attributed to the mobile nature of the marine vessels, most of which travel between multiple jurisdictions and nations. The problem of mobility may be addressed at the federal level for each nation, but most federal agencies have granted authority to regional levels that do not have the resources to regulate marine vessel emissions, especially in regards to

³ This analogy is similar to what is used by Melious.

transboundary enforcement. What is unique about each jurisdiction is that many of the areas overlap and none want to overstep the bounds of another.

Transboundary management may be the best option to regulated marine vessel emissions within the Georgia Basin/Puget Sound region, and with both the United States and Canadian federal authorities having similar ideas on how to manage marine vessels it is feasible that collaborative planning will occur in the near future. This convergence among ideas poses the question on how two nations can work together to cooperatively manage one shared common area.

In an effort to distinguish the problem among cooperative management with the Georgia Basin/Puget Sound region addressing marine vessel emissions, all organizations directly associated with air quality, specifically that of marine vessel emissions, have been listed [in descending order based on geographic scale] to distinguish the current policy or regulatory efforts addressing marine vessel emissions cooperatively and on each side of the Canada/United States border.

International Joint Commission

The International Joint Commission (IJC), which was created by the Boundary Waters Treaty 1909, is one of the earliest international agreements to address pollution. The IJC consists of six commissioners, three from the United States and three from Canada, all of which are appointed positions. The IJC has the power to advise the government on issues and also has the authority to arbitrate matters referred to it by both governments, but this has not occurred (Melious 2003).

The IJC is primarily associated historically with matters concerning water quality and quantity issues but has also addresses air quality issues along the Canada-United States border. This resulted in the establishment of the International Air Quality Advisory Board (IAQAB). In 1998, the IAQAB issued the "Special Report on Transboundary Air Quality Issues," stating that air quality standards in British Columbia and Washington State could be addressed more thoroughly; this included more monitoring stations and cooperative management (IJC 2004).

International Maritime Organization

The International Maritime Organization (IMO) is a permanent international organization established to promote maritime safety. The purpose of the organization is "to provide machinery for cooperation among Governments in the field of governmental regulation and practices relating to technical matters of all kinds affecting shipping engaged in international trade; to encourage and facilitate the general adoption of the highest practicable standards in matters concerning maritime safety, efficiency of navigation and prevention and control of marine pollution from ships" (IMO 2004).

The IMO administered the International Convention on the Prevention of Pollution from Ships and Shipping (MARPOL 73/78) that regulates waste disposal from ships. Within MARPOL is Annex VI – Prevention of Air Pollution from ships, which limits the amount of SO_x and NO_x from stack emissions (IMO 2004). Recently, May 18, 2003, Annex VI was

ratified by 15 countries constituting 50% of the world's merchant shipping and will go into effect on May 19, 2005.⁴ Neither Canada or the United States have ratified MARPOL Annex VI.

Annex VI establishes goals to reduce sulfur in fuels to 4.5% for marine fuels and also designated SO_x Emissions Control Areas (SECA) where sulfur fuel must be below 1.5%.⁵ The Annex further designated NO_x standards for ships built after January 2000 and also would create provisions to regulate volatile organic compounds (VOC), and ozone depleting substances. (IMO 2004).

British Columbia/Washington State - Statement of Intent (SOI) Addressing Air Quality

The Regional Director General of Environment Canada, Pacific and Yukon Region and the Regional Administrator of EPA Region 10 signed a statement of intent (SOI) in August 2002 to acknowledge air quality “and the interdependency the national and regional economies of the two countries create a need to ensure collectively that the policies and regulatory frameworks of the two countries are complementary.”

Georgia Basin/Puget Sound International Airshed Strategy Coordinating Committee

The British Columbia/Washington State statement of intent (SOI) brings together individuals representing the stakeholders involved in air quality management in British Columbia and Washington State. This group, known as the International Airshed Strategy Coordinating Committee includes the Environmental Protection Agency (EPA), Northwest Air Pollution Authority (NWAPA), Puget Sound Clean Air Agency (PSCAA), Environment Canada, Fraser Valley Regional District (FVRD), Greater Vancouver Regional District (GVRD), Department of Ecology (DOE), the Swinomish Indian Tribe, the National Park Service (NPS), and Rowan Williams Davies & Irwin Inc. (RWDI). The goal of the committee is to achieve “air quality ‘for all citizens’”. This entails principles that include; achieving current goals of the involved stakeholders, the consideration of air quality within an ecosystem approach, and actions that will take into consideration costs and benefits (IAS 2004).

The goal of this group is to recommend option(s) for cooperative management and would either add an Annex to the existing air quality agreement between Washington and British Columbia or simply recommend actions that can be taken by individual agencies that will address the air pollution concerns within the region. This includes:

- ❑ Establish a practical and effective instrument to address shared concerns regarding transboundary air pollution.
- ❑ Enhance air quality management practices to protect public and ecosystem health

The goal for this recommendation is June 2004 (IAS 2004).

⁴ The nations that have ratified Annex VI as of October 19, 2004 are: Azerbaijan, Bahamas, Bangladesh, Barbados, Denmark, Germany, Greece, Liberia, Marshall Islands, Norway, Panama, Samoa, Singapore, Spain, Sweden, United Kingdom and Vanuatu.

⁵ There only designated SECA is the Baltic Sea.

Environment Canada

At the federal level in Canada, Environment Canada has not adopted any regulations or policies that address marine vessel emissions. Through its efforts to catalyze regional action and authority over international environmental issues, Environment Canada does play an integral role addressing within the Georgia Basin/Puget Sound region and has created the Georgia Basin Ecosystem Initiative (GBEI), which is now the Georgia Basin Action Plan (GBAP), and has funded numerous studies addressing marine vessel emissions. Currently, Environment Canada is finalizing a report, *Management Options for Marine Vessel Emissions*, addressing feasible management options for marine vessels within the Georgia Basin/Puget Sound Region (Green 2004).

As of October 2004, Canada has not ratified MARPOL Annex VI and it does not appear that ratification will occur any time soon. Officials note that Canada desires to establish its own regulations addressing marine vessel emissions before it ratifies Annex VI (Green 2004).

Transport Canada

Transport Canada is a federal agency that has jurisdiction over marine vessel emissions. Transport Canada receives its authority from the Canada Shipping Act – Air Pollution Regulations. These regulations limit smoke emissions from ships in Canadian waters within one mile of land and further prohibit blowing soot within 1,000 yards of land. Transport Canada delegates jurisdictional authority to regional air authorities to administer its regulations and rarely, if ever, enforces any rules that would directly impact air emissions from marine vessels (Green, Transport Canada 2004).

Environmental Protection Agency

The United States Environmental Protection Agency (EPA) is a federal agency that can adopt emissions standards for marine diesel engines that will be installed on vessels flagged or registered in the United States (Elson 2004). This authority is granted to the EPA through the Clean Air Act of 1990 (CAA90) that states that delegated authorities shall “conduct a study of emissions from nonroad engines and nonroad vehicles to determine if such emissions cause, or significantly contribute to, air pollution which may reasonably be anticipated to endanger public health or welfare.”⁶ Under the CAA90, the EPA has created policies to address the emissions from marine vessels.

Currently the EPA has set a national NO_x standard for all new ships. This policy, *Part II - Control of Emissions of Air Pollution from Nonroad Diesel Engines and Fuel Proposed Rule* (Part II - 40 CFR Parts 9 and 94), will reduce NO_x by implementing standards for new marine diesel engines built after January 1, 2004, or Tier 1. Tier 2, which will be implemented in 2007, will require further reductions in marine engines.

In May 2003, the EPA proposed diesel fuel requirements to lower SO_x emissions. This was published in *Part II - Control of Emissions of Air Pollution from Nonroad Diesel Engines and Fuel Proposed Rule*, and will become effective in 2007, but will not apply to marine fuels.

⁶ Delegated authorities will vary between states. In Washington, local or regional authorities are responsible for air inventory analysis.

This exemption occurred because the EPA was concerned that “regulating fuel sold in the US would not necessarily ensure that lower-sulfur fuel is used in US waters, since ships could purchase their fuel in other countries.” (Part II - 40 CFR Parts 9 and 94) Other initiatives that the EPA is working on include the West Coast Diesel Emissions Reductions Collaborative which is still in its early development stages.

As of October 2004, the United States has not ratified MARPOL Annex VI and it does not appear that ratification will occur any time soon. Officials note that the United States wishes to establish its own regulations addressing marine vessel emissions before it ratifies Annex VI (Elson 2004).

Department of Ecology

Under the United States system of cooperative federalism the Washington State Department of Ecology (DOE) has the authority to develop Washington’s State Implementation Plan (SIP), which delegates air authority to the county or multi-county level (RCW 70.94 and RCW 43.21A and 43.21B). The DOE does not regulate marine vessel emissions, but has signed a memorandum of understanding (MOU) to work with other agencies on “cross-border air quality impacts” relating to air permits (MOU 1994).

Northwest Clean Air Agency

Northwest Clean Air Agency (NWCAA), formally Northwest Air Pollution Authority (NWAPA), is a regional regulatory authority that is responsible for enforcing air quality laws and regulations in Island, Skagit, and Whatcom counties. This agency does not have any *direct* regulations that effect marine vessels (Mahar 2004, Randles 2004). Regulations that do affect marine vessels are those that apply to air emissions as a whole, this includes opacity limitations that may not exceed 20% and PM emissions limitations. Sulfur content in fuels is also regulated, but marine vessels are exempt from this rule (Randles 2004).

The NWAPA has the authority to regulate marine vessels, but only when in port and the agency has cited vessels for its opacity exceedances (Randles 2004). The NWAPA has also signed a MOU to work with other agencies on “cross-border air quality impacts” relating to air permits (MOU 1994).

Puget Sound Clean Air Agency

The Puget Sound Clean Air Agency (PSCAA) is a regional regulatory authority that is responsible for enforcing air quality laws and regulations in Snohomish, King, and Pierce counties. It is one of seven local air agencies in Washington State (PSCAA 2004). The PSCAA does not have any *direct* regulations that affect marine vessels. The only time PSCAA can regulate marine vessels is when they are in port. These regulations include exceedances of visual standards (i.e. opacity limitations of 20%) and the burning of refuse aboard vessels (Hudson 2004).

The PSCAA has the authority to regulate marine vessels but only when in port, and they have cited marine vessels for opacity exceedances. Currently the PSCAA has voluntary agreements among ports and vessels that encourage the use of low sulfur fuels and is trying to

establish a West Coast Initiative to become a low-sulfur region. This initiative would include California, Oregon, Washington, as well as Canada and Mexico (Hudson 2004).

Greater Vancouver Regional District

The Greater Vancouver Regional District (GVRD) is an operational, administrative, and planning jurisdiction that has air quality authority over sources within its region but does not enforce emission limits on marine vessels (GVRD 2004). Policies that are currently being implemented by GVRD are through provincial authority. GVRD's air authority comes from their Air Quality Management Plan and is currently being updated and plans to address marine vessels. Currently the AQMP states; "While no emission reduction measures have been specified for aircraft, railway locomotives, marine vessels and off-road vehicles, the emission inventory shows these sources, particularly marine vessels, to be significant. The AQMP calls for further investigation of the emission control aspects of these sources in order to determine appropriate emission reduction strategies."

The AQMP also includes recommendations from the federal government to include marine vessel in inventory data to "develop appropriate emission reduction strategies."

While GVRD does not regulate marine vessels, it has produced documents to further the knowledge of air emissions from marine vessels under their AQMP. This includes the numerous inventory models for marine vessels within the Georgia Basin/Puget Sound region (Newhook 2004). The GVRD has also signed a MOU to work with other agencies on "cross-border air quality impacts" relating to air permits (MOU 1994).

Fraser Valley Regional District

The Fraser Valley Regional District (FVRD) does not have any regulatory enforcement authority when it comes to air quality, but plays a minimal role in the region. The FVRD has an AQMP that seeks to "identify air quality issues and goals, and to identify options for future air quality policy and management strategies." Further, the FVRD AQMP provides information on current air quality issues and initiatives to further develop a regional AQMP. What FVRD primarily contributes to the region in regards to air pollution are emissions inventories (FVRD 2004).

Convergence

Marine vessels contribute a significant amount of air pollution within the Georgia Basin/Puget Sound region, especially in the case of nitrogen oxides (NO_x), sulfur oxides (SO_x), and particulate matter (PM). The air pollution from marine vessels may be attributed to policies and regulatory based measures that do not encourage or require marine vessels to reduce emissions or economic opportunities that take precedence over environmental protection.

The region's modern maritime ports have become beacons of efficiency, productivity and economic prosperity. The enormous increase in international trade, especially with the Pacific Rim nations, has fueled remarkable growth in trade volumes through west coast ports, especially those located within the Georgia Basin/Puget Sound region. The success of these gateways in meeting and responding to booming trade volumes is vitally important to the economies of

western North America (Air Quality—International Trade and Transportation 2004), thus placing environmental regulations second.

However, success has brought with it significant challenges. Concerns about air quality, traffic congestion and land use planning have become major topics of discussion among nations, states, regional and local governments and communities. Within the Georgia Basin/Puget Sound region, marine vessels have become the focus of binational, and even international, cooperative efforts, primarily because they are a significant source of air pollution. The difficult question facing both Canada and the United States is how to cooperatively address the environmental concerns associated with ocean going vessels and simultaneously maintain the economic prosperity among ports in both nations.

To address the issue of marine vessel emissions, regional, state, and federal pressure may be required for both the United States and Canada to promote actions that substantially address the transboundary air pollution caused by marine vessels. Although governments have formed international cooperative groups to address air quality within the region, most action, though minimal due to the infancy of the issue, is taking place at a federal level due to national and international scope of the issue. The Environmental Protection Agency is presently working on the West Coast Diesel Emissions Reductions Collaborative as well as setting performance standards for new marine diesel engines that will assist in reducing particulates from marine vessel emissions. Environment Canada is completing a report addressing management options within the Georgia Basin/Puget Sound region for marine vessels and will include voluntary, regulatory, and market-based options to further reduce emission from ocean going vessels. The IAS, the collaborative group of environmental managers, is beginning to formulate ideas for cooperative management but lacks any enforcement authority. Action is also being taken at the local level but due to enforcement authority only voluntary measures are being taken, this is illustrated by voluntary agreements PSCAA has with the implementation of shore-side power and making low sulfur fuel available. Addressing marine vessel emissions within the region has just recently taken precedence among both nations, but driving economic factors still play a fundamental role in the development of new regulations among marine vessels and port authorities.

Marine vessel emissions are also not unique to the Georgia Basin/Puget Sound region, regional or international groups do provide a great deal of input on how to address the issue of emissions within Georgia Basin/Puget Sound region, especially in regards to the recent ratification of MARPOL 73/78 Annex VI. Numerous parties in both nations have expressed interest in investigating the feasibility of making the Georgia Basin/Puget Sound a SECA, but opponents argue that SOx emissions are not substantial enough for such designation. What is clear by both nations is that regulations will be adopted within each country before either ratifies Annex VI. Although such working groups as Environment Canada and the Environmental Protection Agency and collaborative groups as the IAS are taking steps to address emissions from ocean vessels, progress is slow.

The United States and Canada agree that marine vessel emissions are a major environmental concern and must be addressed, but minimal actions are being taken by either country. Groups as the IAS, regional, state, and federal air agencies, studies addressing marine vessel emissions on both sides of the border, and a mutual concern for increased air quality show the beginning of convergence in environmental regulations and the need to cooperatively address marine vessel emissions within the Georgia Basin/Puget Sound region.

Georgia Basin/Puget Sound



Figure 1: Georgia Basin/Puget Sound Region (Pacific Northwest National Laboratory 2004).

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